

Chapter 8.5

Lifting operations and equipment safety

This could be you . . .

A crane load fell 3 feet from a 20-ton overhead crane hook. The operator was concentrating on the load itself and not on the path of travel. A section of the hoist rope hung up on an air handler pulley cover in the path of travel. The hoist rope unseated itself and dropped the load. The crane had to be shut down, repaired, and inspected before it could be used again.

1. Applicability of this chapter

You are required to follow this chapter if you manage, operate, service, or maintain lifting equipment as described in paragraph 2 below. Paragraph 15 lists the responsibilities of organizational directors, program managers, contract project managers, the Center Operations Directorate, the Safety and Test Operations Division, and the program offices.

2. What this chapter covers

This chapter covers minimum safety requirements for operating any mechanical device designed for lifting or lowering, and supplements the requirements in NASA-STD 8719.9, “Standard for Lifting Devices and Equipment,” and JPD 8719.1, “JSC Material Handling Policy.” It applies to overhead and mobile cranes, powered industrial forklift trucks, manually operated material handling equipment, and commercially owned cranes used at JSC.

Requirements for lifting operations and equipment safety

3. Requirements for lifting equipment and operating procedures for lifting equipment

You shall follow these requirements for lifting:

- a. All lifting equipment and operating procedures for lifting equipment shall at least meet the requirements for “noncritical lifts” in NASA-STD 8719.9, “Standard for Lifting Devices and Equipment,” JPD 8719.1, “JSC Material Handling Policy,” and other requirements listed in this chapter. NASA-STD 8719.9 covers requirements for design, testing, inspection, maintenance, operation, personnel certification and marking requirements for lifting devices and associated equipment used to support NASA operations.
- b. Use the pre-lift checklist in JPD 8719.1 and use JSC Form 941, “Pre-Lift Checklist,” to plan and evaluate your lifting operations.

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- c. Use only electric powered lifting equipment inside buildings to prevent carbon monoxide accumulations. The Safety and Test Operations Division and the Clinic Services Branch shall approve any proposed indoor use of combustion-engine-powered equipment. Pay special attention to the outdoor placement and location of combustion-powered equipment to prevent the entrainment of carbon monoxide and other combustion products into JSC buildings, tunnel system, structures, etc.

4. Requirements for critical lifts

Critical lifts involve lifting and lowering special high-dollar items, such as spacecraft, one-of-a-kind articles, or major facility components whose loss would have serious program impact. Critical lifts also include operations with personnel and equipment safety concerns beyond normal lifting hazards. The following requirements apply to critical lifts:

- a. Critical lifts shall also follow the requirements for “critical lifts” in NASA-STD 8719.9.
- b. Safety personnel shall monitor critical lifts to ensure that they follow all of the requirements in NASA-STD 8719.9.

5. Commercially owned cranes

Commercially owned cranes are contractor- or subcontractor-owned, -rented, or -leased cranes. Critical lifts and cranes shall meet the following requirements:

- a. Follow the requirements in paragraph 4 above.
- b. Critical lift cranes shall meet OSHA requirements and ASME B30.5, “Mobile and Locomotive Cranes.”
- c. Before using a crane for a lift, you shall provide the Safety and Test Operations Division with the following information:
 1. Type of crane and capacity.
 2. The kind of lift (critical or noncritical) that the crane will make.
 3. The item to be lifted, the weight of the item, and the location of the lift.
 4. The purpose of the lift (task).
 5. The schedule, estimated start and completion.
 6. Any other pertinent information to include the crane’s load chart and a pre-lift checklist as described in JPD 8719.1 and JSC Form 941, “Pre-Lift Checklist.”

6. Requirements for powered industrial forklift trucks

If you use a forklift, you shall follow these requirements:

- a. Make sure forklift trucks meet the design and construction requirements established in ASME B56.1, “Safety Standard for High Lift and Low Lift Trucks,” and in 29 CFR

1910.178, "Powered Industrial Trucks." Chapter 12 of NASA-STD 8719.9 lists safe operating requirements for powered industrial trucks (forklifts).

- b. Inspect the forklift per paragraph 12.4 of NASA-STD 8719.9 and document periodic inspections per subparagraph 12.4.7.
- c. Whenever possible, use non-CO-producing equipment such as electric-powered equipment, lifts, or forklifts inside enclosed or semi-enclosed areas. Never allow CO-producing motors to idle in enclosed or semi-enclosed areas. The Safety and Test Operations Division and the Clinic Services Branch shall approve any proposed indoor use of combustion-engine-powered equipment. If approval is granted, the Clinic Services Branch may require CO monitoring and exhaust ventilation. Additionally, if approval is granted, coordinate with the facility manager for work scheduling and occupant notifications and with the Fire Protection Services for Fire Alarm Outages where engine exhaust could activate smoke detectors. Pay special attention to the outdoor placement and location of combustion-powered equipment to prevent the entrainment of CO and other combustion products into JSC buildings, tunnel system, structures, etc.
- d. Charge batteries only in well-ventilated areas that meet ASME 56.1 and National Fire Protection Association Standard 505. Keep vent caps in place to avoid electrolyte spray when charging batteries of electric forklifts. Make sure that vent caps are functioning.
- e. If you use forklift extensions; you shall:
 1. Follow ASME 56.1.
 2. Use only manufacturer-approved extensions.
 3. Follow the manufacturer's recommendations.
 4. Uniquely identify the extensions.
 5. Use only a professionally modified forklift's load chart.

7. Requirements for other lifting equipment

You shall follow these requirements:

- a. Use other lifting equipment such as low-lift pallet trucks, hand trucks, man lifts, aerial platforms, and dollies only for the purpose intended by the manufacturer.
- b. Never operate this equipment unless you have been trained and certified by the proper authority.
- c. Follow the manufacturer's instructions and the appropriate chapters of NASA-STD 8719.9.

8. Possible issues during lifting operations

If you will handle any of the materials on this list, you shall follow the requirements referenced before starting the lifting operations.

For handling and storing . . . Follow this standard . . .

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Hazardous materials	Chapter 5.1, "Fire safety," and Part 9, "Safety and health practices for hazardous materials," of this handbook.
Flammable liquids and gases	MSDSs and other procedures found in Chapter 5.1 of this handbook.
Cryogenic materials	Chapter 6.5, "Cryogenic materials and gases: how to work with them safely," of this handbook.
Explosives and propellants	Chapter 9.5, "Explosives and propellants safety," and Chapter 9.1, "Hazardous materials safety and health," of this handbook. Appropriate paragraphs of NASA-STD 8719.9.

9. Requirements for slings and rigging equipment

Slings and rigging equipment shall meet the requirements in NASA-STD 8719.9. These include:

- a. Testing per paragraph 10.3.
- b. Inspection per paragraph 10.4 and supporting documentation per subparagraph 10.4.7.

10. Precautions for moving or operating a mobile crane

If you are in charge of moving or operating a mobile crane, you shall follow these requirements as well as the requirements in NASA-STD 8719.9, paragraph 5.7:

- a. Determine the path of travel and inspect it for hazards before the operation begins. Make sure clearances along the path of travel are adequate. Pay special attention to the following:
 1. Power lines – keep them clear of the crane at all times
 2. Personnel or objects in the crane's path of travel
 3. Weight limits for the roadway or bridges
- b. Appoint a person responsible for determining and controlling the safety of the operation. These responsibilities include positioning of the crane and the load, boom extension and radius, ground support, travel route, and speed of movement.
- c. Hold a pre-departure crew safety meeting. Discuss the route and any hazards or conditions that the crane might encounter; such as; proximity of overhead power lines, close vertical or horizontal clearances, speed limits, planned stops, escort positions, and other special instructions. Make sure that no one other than required operating personnel are permitted on the equipment being moved.
- d. Make sure that safe load capacities, operating speeds, and other essential data are posted in or on equipment being driven or transported.
- e. Take these actions when moving a crane:
 1. Place flags and warning signs on the crane or vehicle before moving it with a secondary vehicle.
 2. Avoid sudden starts and stops.

3. Stop if you encounter overhead power lines that appear to be too close and make sure you can clear them safely with a 10-foot space or a verified de-energized line. Note that the clearance distance will change as a function of the line voltage. Ten feet is for at or less than 50, 000 volts. Treat all overhead lines as energized until you are certain it is safe to proceed.
- f. Maintain at least a 2-foot clearance between the crane boom or jib and nearby walls, overhead trestles, columns, or other structures.

11. Requirements for working under a suspended load

OSHA requirements prohibit putting people under suspended loads. The Department of Labor approved an alternate standard for NASA to allow employees to work under suspended loads if certain conditions are met. However, you are discouraged from putting workers under suspended loads unless absolutely necessary to fulfill NASA's mission. This includes multiple load lifts (Christmas tree loads) because this practice requires personnel to work under or near suspended loads. You shall follow these requirements:

- a. Follow the requirements in Appendix A of NASA-STD 8719.9 if working under a suspended load is necessary.
- b. The Director, Safety and Mission Assurance, shall approve all work under a suspended load. To get approval, send your request and all documentation required by Appendix A of NASA-STD 8719.9 to the Safety and Test Operations Division.

Other requirements and responsibilities

12. Variances to lifting requirements

To get a variance to any lifting requirement, including equipment design requirements, submit a variance request as described in Chapter 1.4, "Written Safety and Health Program," of this handbook. The Safety and Mission Assurance Office will forward your request to the Center Director or NASA Headquarters as needed. Paragraph 1.7 of NASA-STD 8719.9 lists NASA's policy for getting a variance (waiver or deviation) to lifting requirements. JSC's Center Director may approve some variances to NASA-STD 8719.9. For critical lift operations that don't meet NASA-STD 8719.9, follow Attachment 1 of JPD 8719.1, "JSC Process for Critical Operations Not Conforming to NASA-STD 8719.9."

13. Training and certification requirements for operating lifting equipment

Operators and crew members shall meet the training and certification requirements in NASA-STD 8719.9 and Chapter 5.8, "Hazardous operations: safe practice and certification," of this handbook. You may arrange safety-related training through the JSC Safety Learning Center or arrange training on your own as described in Chapter 4.1, "Program Description"

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(for safety and health training), of this handbook. Consult your organization's policies and processes for certification.

14. Other requirements

As an operator or crew member, you shall follow these requirements as well as this chapter:

- a. NASA-STD 8719.9
- b. JPD 8719.1, "JSC Material Handling Policy."
- c. 29 CFR 1910 Subpart N, "Material Handling and Storage"
- d. JSC 07877, "Certification of Operators and Crew Members in Lifting Program Hardware"
- e. NSTS 5300.4, "Safety, Reliability, Maintainability, and Quality Provisions for the Space Shuttle Program"
- f. JSC 08114, "Shuttle Program Requirements for Periodic Certification of Material Handling Equipment and Operating Personnel"

15. Other responsibilities for lifting operations and equipment safety

The following organizations have responsibilities for lifting operations:

- a. As a *director, program manager, or contract project manager*, you are responsible for:
 1. Evaluating all lifting operations in your organization and making informed decisions on the risks they pose.
 2. Determining which lifting operations in your organization are critical. You may delegate the authority for determining critical lifts, but you shall do it in writing.
- b. The *Center Operations Directorate* is responsible for:
 1. Preparing and maintaining up-to-date lists of all overhead cranes and fixed hoists.
 2. Developing detailed inspection and test procedures, and test criteria for each item listed.
 3. Carrying out a program to periodically inspect existing and permanently installed handling and lifting equipment.
 4. Supervising the adjustment or modification of all cranes and hoists.
 5. Keeping inspection and recertification records as described in this chapter.
 6. Keeping records of all material-handling equipment used for critical lifts as defined in NASA-STD 8719.9.
 7. Evaluating the adequacy of newly purchased handling and lifting equipment for permanent installation. This includes coordinating a review of design specifications,

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- manufacturing controls, and operational acceptance testing to make sure that the equipment satisfies NASA-STD 8719.9.
8. Developing processes to identify critical lifting operations, lifting devices, and equipment that shall meet critical lift requirements. Get input from facility, program, user, safety, and quality assurance personnel. Document the results of the process and have it approved as a minimum, by the Director, Safety and Mission Assurance.
 9. Making sure JSC has documentation, procedures, and controls in place to ensure that leased, owned, or rented special-purpose mobile equipment is adequate for its intended use and meets requirements that apply.
- c. The *Safety and Test Operations Division* is responsible for reviewing lifting operations and certifications to ensure that all requirements are being met.
 - d. *Program offices* are responsible for making sure contracts require contractor-directed lifting operations to meet:
 1. JSC 08114, “Shuttle Program Requirements for Periodic Certification of Material Handling Equipment and Operating Personnel”
 2. NASA-STD 8719.9